STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

Report No. SS23-01

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To: Teresa Benson, Forest Supervisor, SQF
Eric LaPrice, District Ranger, Western Divide RD
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From: State and Private Forestry, Forest Health Protection, South Sierra Shared Service Area

Subject: **Tree Failure in McIntyre Housing Tract, Western Divide Ranger District, Sequoia National Forest**

Background

On February 16, 2023, Forest Health Protection was informed that 33.8-inch diameter at breast height (DBH) ~150 ft tall white fir had snapped in McIntyre Housing tract of Sequoia National Forest and fallen through the roof of house number 27. It was assumed to have come down five days previously. John Gomez forwarded FHP image 1 and requested a visit to examine the broken tree.

Image 1. Failed portion of tree on House #27, photographed February 11, 2023. Photo courtesy of J. Gomez

Initial Observations

It was estimated that the offending white fir snapped at 70ft above the ground (image 2) possibly due to a weak point. While numerous pieces of hardware and wires were attached to the tree none were within 20 ft of the break, it is highly unlikely that any introduced fungi at these attachment points would have contributed to the failure. Profuse boring dust caused by insects was noted in several spots around the base and lower bole fissures – an indication that the base had been infested and the tree was severely stressed. Bark was not removed to confirm insect identity, and no other signs were noted further up the stem. Examination of the broken tree and nearby surrounding white firs did not detect *Echinodontium tinctorium* commonly known as the Paint fungus conk. This fungus is a major cause of failure of maturing white fir in the Sierra Nevada, and conks don't usually appear until late in the decay cycle (Boyce, 1961) which is why early detection is very difficult. The initial clean-up crew had removed the main section of the tree from the house, leaving cut sections at the front and back which were examined. Shed needles and smaller branches of the cut tree were still verdant green scattered on the ground. There was no discoloration or fading observed in this foliage. Had this tree remained alive until the summer, there is a high probability that the crown would have displayed symptoms of water stress due to the reduced amount of non-decayed sapwood to support the whole crown above the break point (image 5).

Image 2. The remaining piece of the failed tree.

Observations of the broken section

Although the failure is assumed to have taken place around February 11, 2023 and examined ten days later, it was still possible to find the stem section with the break (the exposed end in image 1).

The two most frequent causes of white fir failure in the South Sierras are caused by either Heterobasidion Root Disease (HRD = *Heterobasidion occidentale*) or Paint fungus. Thus, presence of these two fungi is initially surveyed for. These fungi can also be clustered in a stand, so examination of surrounding host trees or other sections of the housing tract was important for detection. Two Forest sawyers (Kyle Walsh and Jacob Kennedy) were able to assist during the visit and cut sizable rounds (aka "cookies") to look for characteristic ring delamination these fungi cause. The sawyers cut and discarded the first 4-inch cookie from the section just above the break, and then cut a second cookie to photograph and take back to the lab for analysis. A sharp chainsaw when cutting sound timber will normally produce shavings approximately equal to the distance between the chain's teeth. However, while cutting the first cookie the sawyer noticed that much of the wood being cut was soft and rotted, for the shavings were broken up chunks rather whole shavings (image 4). The sawyer was able to push his fingers into rotted wood, something not expected in an incipient delaminating decay. The cookies (images 3, 5, 6, & 7) provided all the information to eliminate the two most common diseases. However, the fractured surface revealed a different type of decay symptom, not one easily explained.

Image 3. Sawyer cutting the discard cookie with the broken section in the background

Image 4. The punky sawdust the saw produced

Image5. Cross section from about 2 ft above the break. The Arc of white sapwood extends from about 2 o'clock through 6 o'clock to 10 o'clock. The arc from 10 to 2 gives the exterior limit of the punky wood

Image 6. Showing the blackened lines of old Ambrosial galleries and the secondary punky decay.

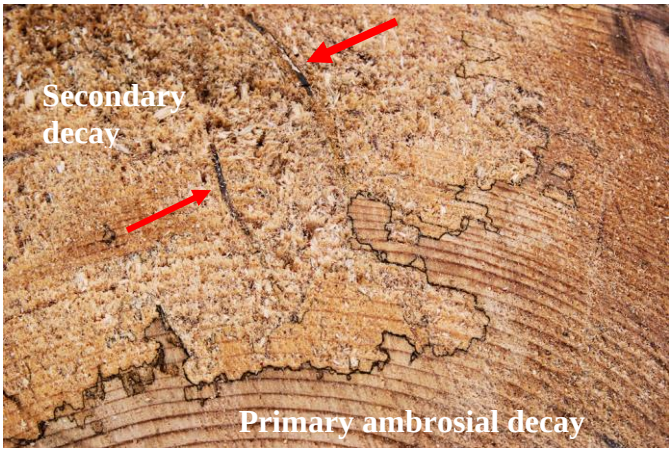

Image 7. A close up to show the overgrown once black ambrosial galleries (arrowed). Black zone lines mark the boundary between secondary decay and older ambrosial attacked wood.

Older ambrosia beetle galleries were noted on the cookie slabs, but especially in the broken stem piece (image 8). These beetles typically move in the wood rather than the subcortical layer compared to bark beetles. The larvae of developing ambrosia beetles eat fungal spores and mycelium of a symbiotic fungus which is farmed in the galleries. Therefore, the fungi not the beetles cause most of the degradation of wood. Once attacking beetles have completed reproduction and new adults have taken flight, those old entry points are now open for a secondary fungal invasion. Images 6 & 7 show a secondary decay fungus colonized the wood previously inhabited by ambrosia beetles. The secondary fungus laid down black zone lines not only to protect its territory from other fungi, but also to prevent water loss (image 7).

Image 8. At the break, ambrosial galleries appear overgrown by a white fungus. There are pockets of a white rot decay. This may be the secondary fungus seen in images 6 & 7.

Conclusions

White fir is one of the least durable conifers of southern Sierra Nevada and logging wounds (or other mechanical wounds) are notorious for becoming infected by decay fungi. Although man-made pruning

wounds are unlikely very high up a tree, it is still possible for an exposed crown to be damaged by branches of surrounding trees in a violent storm.

While there was no evidence to support presence of either Paint fungus or *Heterobasidion* root disease in the broken sections examined during the visit, a secondary white rot fungus had invaded a localized ambrosia beetle infestation high on the bole, and significantly weakened the structural integrity of the wood in this general area. It is at this point that there would have been the greatest amount of grain deviations and decay may have been enough to cause the bole snap with strong wind pressure. Isolations from the sampled disks will hopefully yield a fungus which can be identified.

FHP plans to return to McIntyre housing tract this spring to monitor the health of several moribund Giant Sequoias affected by the 2020 Castle Fire and will make additional time to assess other trees in this tract. However, as this tree exemplifies that any tree can fail, and frequent monitoring would be prudent to prevent hazards that can be identified.

FHP thanks the Forest for the assistance of Kyle Walsh and Jacob Kennedy, and if there are any questions or concerns regarding this report, please do not hesitate to contact us.

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Reference

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